



US006561991B2

(12) **United States Patent**  
McLeod et al.

(10) Patent No.: **US 6,561,991 B2**  
(45) Date of Patent: **May 13, 2003**

(54) **NON-INVASIVE METHOD AND SYSTEM OF QUANTIFYING HUMAN POSTURAL STABILITY**

5,964,719 A \* 10/1999 Costello et al. .... 600/595  
6,234,975 B1 \* 5/2001 McLeod et al. .... 600/552

#### FOREIGN PATENT DOCUMENTS

(75) Inventors: **Kenneth J. McLeod**, Stony Brook, NY (US); **Clinton T. Rubin**, Port Jefferson, NY (US)

WO WO 99/07280 2/1999

\* cited by examiner

(73) Assignee: **The Research Foundation of the State University of New York (SUNY)**, Stony Brook, NY (US)

*Primary Examiner*—Charles G. Freay

*Assistant Examiner*—Han L. Liu

(74) *Attorney, Agent, or Firm*—Dilworth & Barrese, LLP

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 11 days.

#### (57) ABSTRACT

A non-invasive method for evaluating a musculoskeletal system of a patient is provided which includes the steps of: providing a vibration measurement device in proximity to a non-rigidly supported platform; measuring a vibrational response of the patient's musculoskeletal system using the vibration measurement device after the patient rests on the non-rigidly supported platform; performing a frequency decomposition of the vibrational response to quantify the vibrational response into specific vibrational spectra; and analyzing the vibrational spectra to evaluate muscle strength, postural stability and bone density. A non-invasive physiologic vibration quantification system is also provided for evaluating the musculoskeletal system of the patient. The system includes vibration means for externally transferring vibrations to the musculoskeletal system and including a vibration measurement device for measuring a response by the musculoskeletal system in accordance with the vibrations transferred by the vibration means and for forming signals representative of the musculoskeletal system response; and an analyzer coupled to the vibration measurement device for receiving the signals from the vibration measurement device and developing a frequency spectrum associated with the signals. The frequency spectrum provides vibrational quantification of the musculoskeletal system for evaluating at least postural stability.

(21) Appl. No.: **09/739,222**

(22) Filed: **Dec. 19, 2000**

(65) **Prior Publication Data**

US 2002/0077567 A1 Jun. 20, 2002

(51) Int. Cl.<sup>7</sup> ..... **A61B 5/103; A61B 5/117**

(52) U.S. Cl. .... **600/587; 600/552**

(58) Field of Search ..... **600/587, 592, 600/594, 595, 552, 590**

(56) **References Cited**

#### U.S. PATENT DOCUMENTS

4,195,643 A \* 4/1980 Pratt, Jr. .... 128/779  
5,103,806 A 4/1992 McLeod et al. .... 128/24 AA  
5,125,412 A \* 6/1992 Thornton ..... 128/670  
5,191,880 A 3/1993 McLeod et al. .... 128/24 AA  
5,271,416 A \* 12/1993 Lepley ..... 128/782  
5,273,028 A 12/1993 McLeod et al. .... 128/33  
5,337,757 A \* 8/1994 Jain et al. .... 128/779  
5,376,065 A 12/1994 McLeod et al. .... 601/98  
5,412,987 A 5/1995 Bergstrom et al. .... 73/517 R  
5,662,118 A \* 9/1997 Skubick ..... 128/733

**16 Claims, 6 Drawing Sheets**

